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DOUBLE LOXOSOMÆ.

W. S. NICKERSON.

WHILE investigating the structure of *Loxosoma davenporti* several abnormal specimens came under my observation. These, five in number, are all double monsters, and in all cases the paired individuals are united in the same manner — side to side ; the oral surfaces are turned in the same direction, and the stalks are so united as to have a common foot. Three of the specimens are fully grown ; the other two are immature, one being a bud still attached to the parent, and the other, though detached when found, was even less developed, and had undoubtedly been separated from the parent by the handling it had undergone in preservation.

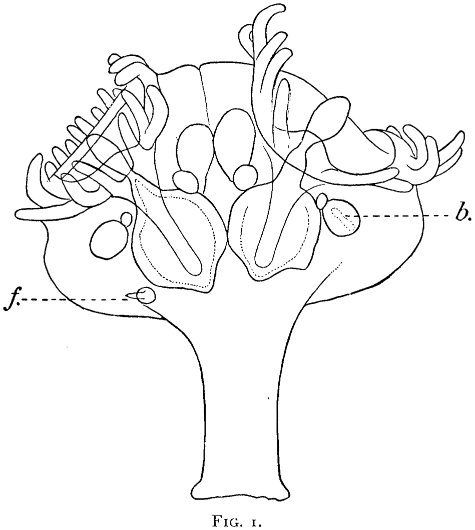

FIG. 1.

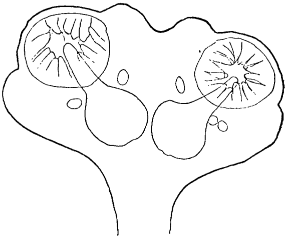

FIG. 2.

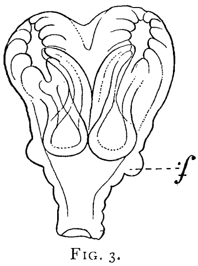

FIG. 3.

FIG. 1. — Anterior aspect. 18 and 19 tentacles. *b.* = bud ; *f.* = flask organ. × 57.
FIG. 2. — Anterior aspect. 16 and 15 tentacles. × 57.
FIG. 3. — Anterior aspect. 11 and 12 tentacles. *f.* = Anlage of flask organ. × 114.

These cases represent three different degrees of union between individuals. Three of the cases, one adult (Fig. 1) and two buds (Figs. 2 and 3), present essentially the same condition. In these a common stalk bears two bodies united side to side, each with its own lophophore, reproductive organs, digestive system, nerve center, and budding zones. In serial sections of the adult (Fig. 1) I have not detected any essential modification of the individual organs. All four of the gonads are ovaries. The two immature buds (Figs. 2 and 3) I have studied only as entire objects, but could discern no abnormalities in the different organs.

A second degree of union is shown by the specimen represented in Fig. 4. Here only the lower parts of the stalks are joined, so that, while the two animals have a common foot, all portions of their bodies above the middle of the stalks are quite separate and normal. The only abnormality observed in individual organs is in the arrangement of the cells of the dorsal row (Fig. 4). Where those of the two individuals come together in the fused stalk near the foot, three rows of the cells instead of two are present for a short distance, and there are slight irregularities in the arrangement of the cells.

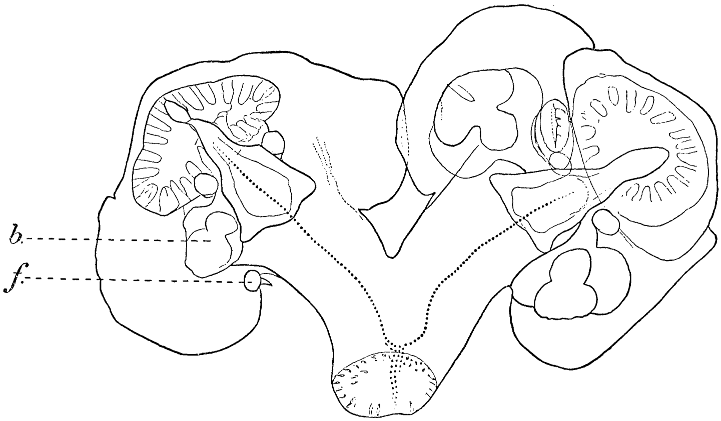

Fig. 4.—Dorsal aspect. *b.* = bud; *f.* = flask organ. × 57.

A third condition, represented in Fig. 5, shows a greater degree of modification of the individuals and requires a more detailed description. The stalk is simple and in no way different from that of a single individual. From the body arise two lophophores, which are quite normal, and bear respectively eighteen and twenty tentacles. In the parts located in the body, abnormalities occur in digestive, reproductive, and nervous systems. The position and arrangement of the buds is also peculiar.

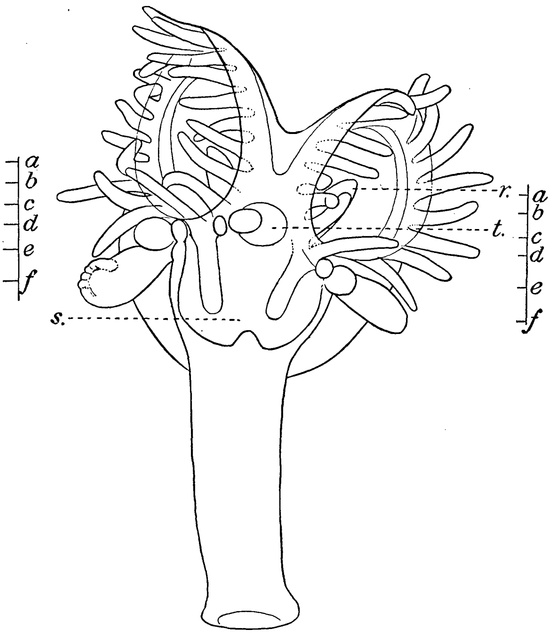

Fig. 5. — Anterior aspect. 20 and 18 tentacles. *r.* = rectum; *s.* = stomach; *t.* = testis. × 57.

The digestive tract consists of a single bilobed stomach, into which lead two gullets, and from which lead two intestines, one gullet and one intestine having the normal relation to each lophophore.

The sexual organs consist of three testes, one median above the stomach somewhat larger than the others, and one on the outer side of each œsophagus. A pair of seminal vesicles, one on either side of the median testis, open to the exterior in normal positions with respect to the two lophophores. From each of the lateral testes a duct communicates with the adjacent vesicle. The median testis has an opening into the left-hand seminal vesicle, but I have been unable to detect one to that on the right side, though the two organs lie close together, their cavities separated only by a membrane.

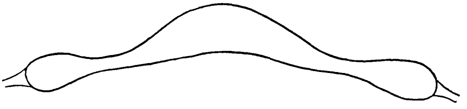

Fig. 6. — Outline of brain made by superposing successive transverse sections. × 250.

The brain has the form shown in Fig. 6, the median portion being somewhat higher than the ends and directly above the median testis. A nerve bundle passes off from each end as from a normal brain.

There are eight buds arising from three budding zones. The two lateral of these zones bear each three buds, the unpaired zone having but two. These latter have the normal relation to the right-hand œsophagus and lophophore, and are unrelated to those of the other side. I have not succeeded in making out the relations of the excretory organs in this case.

It should perhaps be noted that in each of the adult double monsters (in which the gonads are developed) the paired individuals are of the same sex (Figs. 1 and 4♀, and Fig. 5♂).

None of the buds developed upon any of the double monsters is double or in any way abnormal. The condition therefore appears to be not heritable.

Two hypotheses may be offered in explanation of the facts given. According to one, the conditions found represent three different stages in a process of longitudinal fission. According to the other hypothesis, which I believe to be the correct one, they have resulted from the incomplete separation of two masses of germinal tissue, destined under normal conditions to give rise to two distinct buds. Each individual of the pair represents the resultant of the tendency toward normal development modified by the hampering influence of the adhering mass of tissue. Each double monster is therefore the result of a compromise between the two conflicting bud Anlagen. There seems to be no good ground for comparing the double monsters of Loxosoma and the double embryos normally produced sexually in the phylactolæmatous Bryozoa.

In opposition to the first hypothesis is the fact that the union between the paired young buds (Figs. 2 and 3) is no more intimate than that between the adults shown in Fig. 1, and is less intimate than that between those shown in Fig. 5. If fission were taking place we should expect the older individuals to show the later stages of the process.

Two facts tend to support the second hypothesis : (1) the position of the individuals of the pair with respect to each other is side to side, as would naturally result from the union of adjacent bud Anlagen ; (2) in all the cases (four) in which it has been possible to determine the number of tentacles they have been found unequal on the two lophophores ; one of these is therefore in each case more advanced in development than the other, as is always the case with two buds which arise side by side, the degree of difference being, moreover, such as our hypothesis would lead us to expect.

In the specimen represented in Fig. 5 the brain and the stomach correspond in each case to two organs fused. The median testis may likewise owe its larger size to its being the result of fusion of two testes ; but whether that be the case or not, its outlet is on the side of the younger individual. The mesial budding zone which has been suppressed or remained undeveloped is that of the younger individual. The latter fact harmonizes well with the theory of fusion, since when two buds come into conflict in their development the younger naturally suffers most. The relations of the median testis, on the other hand, can hardly be considered as lending support to either hypothesis.

Fission seems inherently improbable in so highly organized an animal as Loxosoma, while against the theory of fusion no such objection holds.

UNIVERSITY OF MINNESOTA,
July 5, 1900.